REMARKS

Status of Claims:

Claims 1-44 are presented for examination.

This amendment changes claims in this application. A detailed listing of all claims that are in the application, is presented, with appropriately defined status identifiers.

Allowable Subject Matter:

Applicant expresses appreciation to the Examiner for the indication that claims 2-22 and 24-44 are allowed.

Claim Rejections:

Claims 1 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (U.S. Patent No. 5,960,041) (hereinafter Calderbank).

With regard to claims 1 and 23, as amended, the rejection is respectfully traversed.

Independent claim 1 recites a data modulation method comprising the steps of:

> "a) converting each N-bit data word of a plurality of N-bit data words of a data bit stream to a corresponding M-bit code word of a plurality of M-bit code words to form a channel bit stream, where the integer M is greater than the integer N;
>
> b) determining a digital sum value of said channel bit stream;
>
> c) detecting a bit sequence of a predetermined pattern in the channel bit stream; and
>
> d) **replacing** a **bit "1"** of the bit sequence in the channel bit stream with a **bit "0"** if the replacement results in said digital sum value approaching zero." (Emphasis Added).

A data modulation method including the above-quoted features has at least the advantages that: (i) each N-bit data word of a plurality of N-bit data words of a data bit stream is converted to a corresponding M-bit code word of a plurality of M-bit code words to form a channel bit stream, where the integer M is greater than the integer N; (ii) a digital sum value of the channel bit stream is determined; (iii) a bit sequence of a predetermined pattern is detected in the channel bit stream; and (iv) a **bit "1"** of **the bit sequence in the channel bit stream** is **replaced** with a **bit "0"** if the replacement results in said digital sum value approaching zero. (Applicant's Substitute Specification; page 3, lines 13-20).

Calderbank neither discloses nor suggests nor renders predictable a data modulation method including the above-quoted features. The Examiner notes that Calderbank discusses prior art in which modulation coding may be implemented by dividing digital information into sets of bits, called information words, and then each information word is used to select a codeword in a codebook. (Office Action; page 2). The Examiner further notes that Calderbank discloses that, "[o]ne way to assure a dc-free sequence is to design a system in which the block digital sum, or the arithmetic sum, of symbols in a **codeword** transmitted over a channel is zero." (Calderbank; column 2, lines 17-21) (Office Action; page 3).

Thus, in the system of Calderbank, it is required that each **codeword** be a dc-free codeword, such that a block digital sum for **each individual codeword** in Calderbank is **zero**. (Calderbank; column 2, lines 17-21; column 4, lines 1-12 and lines 15-20). By having each individual codeword be dc-free, Calderbank is assured that a dc-free sequence is produced when the information words are converted to codewords. (Calderbank; column 2, lines 17-21).

As a consequence, there would be no reason in the system of Calderbank to determine a digital sum value of a sequence formed from the codewords of Calderbank, because the digital sum value of the sequence would always be zero since each codeword in Calderbank must be a dc-free codeword. (Calderbank; column 2, lines 17-21; column 4, lines 1-12 and lines 15-20). Moreover, there would be no reason in the system of Calderbank to **replace** a **bit "1"** in a sequence formed from the codewords of Calderbank with a **bit "0"**, because any sequence formed from the dc-free codewords of Calderbank is already assured to be dc-free,

so replacing a bit "1" in such a sequence with a bit "0" would cause the sequence to **no longer be dc-free**. (Calderbank; column 2, lines 17-21; column 4, lines 1-12 and lines 15-20). Thus, Calderbank actually **teaches away from** replacing a bit "1" in a channel sequence formed from the codewords of Calderbank with a bit "0", because Calderbank wants channel sequences that are dc-free, and such a replacement in the system of Calderbank would cause the channel sequence to not be dc-free. (Calderbank; column 2, lines 13-21; column 4, lines 1-12 and lines 15-20).

In contrast, the present claim 1 recites the steps of, "detecting a bit sequence of a predetermined pattern in the channel bit stream", and, "**replacing** a **bit '1'** of the bit sequence in the channel bit stream with a **bit '0'** if the replacement results in said digital sum value approaching zero." (Emphasis Added). Such steps may be important, for example, if codewords used to form the channel bit stream are **not necessarily dc-free codewords**. (Applicant's Substitute Specification; page 3, line 13 – page 6, line 20). The Examiner recognizes that, "[t]he prior art does not explicitly disclose the step of 'detecting a bit sequence of a predetermined pattern in the stored channel bit stream'." (Office Action; page 2). Moreover, as discussed above, there would be no reason in the system of Calderbank to **replace** a bit "1" in a sequence formed from the codewords of Calderbank with a bit "0", because any sequence formed from the dc-free codewords of Calderbank is already assured to be dc-free, so replacing a bit "1" in such a sequence with a bit "0" would cause the sequence to no longer be dc-free. (Calderbank; column 2, lines 17-21; column 4, lines 1-12 and lines 15-20). Therefore, Calderbank neither discloses nor suggests nor renders predictable the recited steps of "detecting a bit sequence of a predetermined pattern in the channel bit stream", and, "replacing a bit '1' of the bit sequence in the channel bit stream with a bit '0' if the replacement results in said digital sum value approaching zero." (Emphasis Added).

The Examiner also states that, "in the case of the detecting bits are 00001000, one of ordinary skill in the art would have recognized that the bit '1' digit needs to be replaced with a bit '0' in order for the sequence to be dc-free." (Office Action; page 3). However, contrary to the Examiner's assertion, replacing the bit "1" digit with a bit "0" in the bits "00001000" will not necessarily make a sequence dc-free, but such a determination depends on other bits

in the sequence. For example, if the bits "00001000" are the entire bit stream, then replacing the bit "1" with a bit "0" will actually increase a dc-content of the bit stream, because the d.c. content is a difference between a total number of ones and a total number of zeros in the bits stream. Also, for example, if the bits "00001000" are part of a larger bit stream that has more 1's than 0's, then replacing the bit "1" with a bit "0" will decrease a dc-content of the bit stream. Thus, the obviousness argument set forth on page 3 of the Office Action lacks merit.

Therefore, independent claim 1, as amended, is neither disclosed nor suggested nor rendered predictable by the Calderbank reference and, hence, is believed to be allowable. The Patent Office has not made out a *prima facie* case of obviousness under 35 U.S.C. 103.

Independent claim 23, as amended, recites a data modulation apparatus with features similar to features of a data modulation method of independent claim 1 and, thus, is believed to be allowable for at least the same reasons that independent claim 1 is believed to be allowable.

Conclusion:

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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